Germany's current situation regarding hybrid and electric vehicles – update October 2014

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Introduction

Global megatrends

- Global warming and reduction of CO2 emissions
- Limited fossil resources
- Increase of renewable energies
- Growth of emerging markets

Motivating factors for HEVs and EVs in Germany

- **EU CO2 emission target** of 95 g/km in 2021 particularly challenging for German OEMs with high share of large, premium cars
  - Electrification of powertrain important lever to avoid CO2 penalties
- ‘Energiewende’ (Energy revolution) High share of renewable energies in Germany; accelerated nuclear power phase-out
  - THG reduction targets -40% in 2020, min. -80% in 2050 compared to 1990
- **Securing future competitiveness of Germany’s automotive industry**
  - More than 700,000 jobs at OEMs and supplier (1 out 7 jobs in Germany direct or indirect associated with automotive industry)
  - 12.6 million cars produced by German OEMs in 2010, thereof 75% for export
German vehicles new at the dealer 2014

- BMW i8
- VW E-up!
- VW Golf GTE
- VW XL1
- Mercedes-Benz S500 PHEV
- Mercedes-Benz B-Class ED
- Audi A3 e-tron
- Porsche Cayenne PHEV

Source: BMW, Volkswagen, autoblog.com, Mercedes-Benz
German vehicles new at the dealer 2014

German OEMs introduce more models to the market

Source: BMW, Volkswagen, autoblog.com, Mercedes-Benz
Industry:
Porsche Cayenne S E-Hybrid

- First Luxury SUV Plug-In Hybrid
  ➔ other OEMs will follow PHEV SUV Trend
  ➔ Volkswagen brands will profit

- World premiere @ Paris Motor Show 2014
- Technical details:
  - 306 kW total (70 kW electric motor)
  - 10.8 kWh battery capacity (Li-Ion)
  - Electric driving range: 36 km
  - 3 h charging time (at 3.6 kW charger)
  - 1.5 h charging time with optional 7.2 kW On-board Charger
  - Possibility to drive pure electrically up to 125 km/h

Industry:
Mercedes strategy - powertrain specific hybridization

- **Diesel Full Hybrid**: S 300 BlueTEC Hybrid
  - 170 kW total (20 kW electric motor)
  - Electric Driving up to 35 km/h

- **Gasoline Plug-In Hybrid**: S 500 Plug-In Hybrid
  - 330 kW total (85 kW electric motor)
  - 8.7 kWh battery capacity (Li-Ion)
  - Electric driving range: 33 km
  - Electric Driving up to 140 km/h

Sources:
http://www.adac.de/_ext/itr/tests/Autotest/ATS165_Mercedes_S_300_BlueTEC_HYBRID_7G_TRONIC_PLUS/Mercedes_S_300_BlueTEC_HYBRID_7G_TRONIC_PLUS.pdf
http://www.mercedes-benz.de/content/germany/mpc/mpc_germany_website/de/home_mpc/passengercars/home/new_cars/models/s-class/w222/facts_/s500pluginhybrid.html
European market overview: EV models on offer/announced

Source: DLR project eMAP
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Germany’s car market

New vehicles in 2013: 2,95 million
(-4.2% compared to 2012)

- Private: 37,9 %
- Diesel: 47,5 %
- Alternative powertrains: 1,5%
- Avg. CO2 emission: 136,4 g/km
- Short-term licensing: 116,000

The number of electric cars doubled in 2013 compared to 2012:

- Significant positive trend for Hybrids
- Positive trend for BEV- almost equal to CNG (and LPG)

Source: www.kba.de
Current sales of HEVs, PHEVs, and BEVs

- **New registrations in 2014 (Jan-Sep)**
  - Hybrids: 20,672
  - of which Plug-ins: 3,053 (15%)
  - BEV: 6,047
  - Conventional
    - SI: 1.2 million
    - CI: 1.1 million

- **Increase of purchase in 2014 compared to 2013 (Jan-Sep)**
  - Hybrids: +8%
  - Plug-Ins: +245.8%
  - BEV: 56%

- Due to statistical reasons, not all PHEV/REEV are shown
Share of HEVs, PHEVs, BEVs in the car stock

- Share in vehicle stock (1\textsuperscript{st} Jan 2014)
  - Hybrids 0,195%
  - BEV 0,028%
  - CNG 0,18%
  - Conventional
    - SI 68,3% (29.96 mio)
    - CI 30,1% (13.22 mio)

- Sales not progressing as expected: in average 140,000 per annum are needed to reach 1,000,000 in 2020.
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German Government adopts electric mobility law (EmoG)

Content
• Definition of privileged vehicles
• Labeling via number plate
• Parking
• Use of bus lanes
• Access to restricted areas

Objectives
• To make EVs more attractive

Background
• So far, no jurisdicative foundation to give privileges to EVs
• Not possible to integrate in transport law
• A common way is strived for throughout Germany
• Expected to be ratified spring 2015, EmoG will end on June 30th 2030.
Definition of privileged EVs in the EmoG

• Previous official definition: only BEV and FCEV

Privileged vehicles in EmoG are:
• Battery electric vehicles (BEV), incl. cars, light duty vehicles, 2-wheelers
• Environmentally friendly plug-in hybrids (PHEVs)
  • With CO2-emissions max equal 50 g/km or
  • With pure electric range
    • more than 30 km, today to year 2018
    • More than 40 km, after 2018

Reasoning
• Minimum electric range is sufficient to allow a high degree of electric driving (on average, 80% of cars drive less than 40 km a day)
• PHEVs as a ‘bridging technology‘ towards complete electrification of the powertrain
Privileges for EVs due to EmoG (1)

Improved visibility/ labeling
• German registered vehicles: new number plate
• Foreign vehicles: sticker

Reasons: to show privileged vehicle, to improve acceptance in society, to help police to enforce the regulation, to demonstrate environmental friendliness

Dedicated parking space
• to enable cities and communities to dedicate parking space for EVs at charging stations and/or offer parking space for free or reduced rates
Privileges for EVs due to EmoG (2)

Use of bus lanes / public roads for dedicated uses
- EmoG provides the possibility for cities/communities to introduce the privileged use of bus lanes etc.
- Power of decision is in the cities/communities
- Evaluation of the usage of the dedicated bus lanes can only be done locally
- An additional regulation was put in place to ‘protect‘ public transport and the safety and easiness of the road traffic flow

Access to restricted areas
- EmoG enables road administrations to exempt EVs from access restrictions due to noise and air quality (Luftkurorte, recreational areas, wohngebiete)
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Public accessible EVSE (September 2014)

- Difference to March 2014 shown in parentheses
- AC 1/2 Phase: 230 VAC / 16 A (≤ 7 kW)
- AC 3 Phase: 400 VAC / 32 A (≤ 44 kW)
- Fast charging primarily 600 VDC / 400 A (240 kW) (CCS / CHAdeMO) and some 500 / 250 A (125 kW)

Ref: Bundesverband der Energie- und Wasserwirtschaft e.V. (BDEW)
Research –Projects started in 2014 (excerpt)

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German Funding strategy for electric mobility still versatile, including

- **Technologies and components** (e.g. electric machines, power electronics, lightweight design)
- (Series) production technologies
- **Demonstration projects** (e.g. fleets, urban logistics)
- **Education and qualification**

BMWi – Ministry of Economics and Energy, BMBF – Ministry of Research, BMVI – Ministry of Transport and Infrastructure, BMU – Ministry of Environment
Summary

- Number of PEVs and HEV increased in 2014
- A trend in PHEV in upper class and SUV segment can be expected
- New electric mobility law in Germany adopted
  - To make electrified powertrains attractive
  - But without monetary incentives
- Positive trend in new registrations for electrified powertrains
  - HEV – very progressive
  - PHEV – low level, but very strong gradient
  - BEV – constant positive trend
- Positive trend in charging infrastructure